

## **STATUS OF CLAIMS**

Claims 10 – 19 are pending.<sup>1</sup>

Claims 1 – 9 were previously cancelled.

Claims 10, and 12 – 15 have been amended.

Claims 20 – 33 have been newly added.

## **REMARKS**

### 35 U.S.C. § 112 Claim Rejections

Claims 13 – 16 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention.

Claims 13 – 16 have been amended to overcome this rejection. No new matter has been added. Particularly, Claim 13 has been amended to clarify that the sintering step recited in Claim 10 comprises a compaction step followed with a thermal processing step. Claim 14 has been amended to recite the pressure values for the compaction step of Claim 13. Claim 15 has been amended to define a hot pressing step, which includes compacting and thermal processing steps performed at the same time. Applicant respectfully submits that Claims 13 – 16 are in full compliance with statutory requirements of 35 U.S.C. § 112, second paragraph. Reconsideration and removal of this 35 U.S.C. § 112, second paragraph rejection is respectfully requested.

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<sup>1</sup> The Examiner has indicated in the Office Action Summary that Claims 10 – 16 are pending whereas the Examiner appears to have examined Claims 17 – 19, as reflected by the Claim Rejections. Applicant assumes that Office Action Summary is a typographical error.

Additionally, Claim 10 has also been amended to improve its readability. Claim 10 as amended recites a method for manufacturing semiconductor granules, which method includes a step of sintering powders of at least one of the recited materials. Further, the step of sintering includes the step of compacting and thermal processing the powders so as to form said granules. No new matter has been added by this amendment.

35 U.S.C. § 102 Claim Rejections

Claims 10 – 17 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Santana (Santana C. J., et al., “The effects of Processing Conditions on the Density and Microstructure of Hot-Pressed Silicon Powder,” Journal of Materials Science, col. 31, 1996, pgs. 4985-4990). Applicant traverses these rejections, as the cited art fails to teach each of the limitations of the pending claims.

35 U.S.C. 102(b) sets forth in part:

A person shall be entitled to a patent unless - (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States.

“A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.’ *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).” MPEP 2131. As set forth below, as to each of claims 10 - 17, there is at least one element which is neither expressly nor inherently described in the cited art.

Moreover, there is no teaching or suggestion in the cited art to modify the cited reference to obtain the claim limitations.

Amended Claim 10 recites:

10. A method for manufacturing semiconductor granules intended to feed a semiconductor material manufacturing melt, said method comprising a step of sintering powders of at least one material selected from the group consisting of silicon, germanium, gallium arsenide, and the alloys thereof so as to form said granules, said sintering step comprising the steps of compacting and thermal processing said powders.

Claim 10 thus recites a method for manufacturing semiconductor *granules* intended to feed a semiconductor material manufacturing melt. The method includes a step of sintering powders of at least one of the listed materials to form the *granules*. The sintering step includes the steps of compacting the powders and thermal processing the powders.

In contrast, the Santana reference reveals a method for manufacturing silicon *wafers*. See Abstract ("Silicon powder was hot pressed into polycrystalline wafers 1.5 in (~ 3.8 cm) diameter using various processing conditions.") (emphasis added); Section titled "Introduction" ("The present effort has two principal objectives. First, the *hot-pressing conditions required to produce a polycrystalline silicon wafer with a density approaching the theoretical density of silicon were to be identified.*") (emphasis added). Unlike Santana, Claim 10 recites a method for manufacturing semiconductor *granules* by sintering powders. A person of ordinary skill in the art would appreciate the difference between a wafer and a granule and the formation of such within semiconductor technology. By way of example, a silicon wafer may have a thickness

on the order of nanometers or micrometers, whereas a granule may have thickness in the order of millimeters. Furthermore, as even recognized in Santana, granules are formed according to a process different from that described in Santana's wafer formation. For at least these reasons, Santana fails to disclose a method for manufacturing semiconductor granules by sintering powders as recited by Claim 10. Reconsideration and removal of this 35 USC 102 rejection is respectfully requested.

In addition, the method disclosed by Santana uses submicrometer powder, a by-product of the fluidized decomposition process of silane ( $\text{SiH}_4$ ) in the production of silicon *pellets*, to form silicon wafers. See Abstract. As described in Santana, such powder also included polycrystalline silicon *pellets* having a size of 1 to 3 mm. See Section "Experimental Procedure." The method of Claim 10, on the other hand, uses powder, a similar by-product of a chemical vapor deposition (CVD) reactor and silicon wafer sawing residues, for forming granules. See Specification, Page 3, lines 18 – 22. The silicon pellets disclosed in Santana are similar to the claimed granules formed by the method recited by Claim 10. However, it is clear from a detailed reading of Santana that Santana's *pellets* forming is not accomplished by the process disclosed by Santana for *wafer* formation. Thus, Santana teaches a completely different method for a completely different purpose as compared to the method recited by present Claim 10.

Still further, Santana's implements a method of forming silicon *wafers* from silicon powders using a sintering process with a given set of parameters, whereas, applicant's claimed invention recites a method for forming *granules* from semiconductor materials using a sintering process having parameters which are vastly

different than those taught by Santana. Granules formed by the method of Claim 10 may be used, for example, to feed a semiconductor melt to form ingots, from which silicon wafers may be formed. It is well-known to one of ordinary skill in the semiconductor material fabrication field that processing parameters such as pressure, temperature and time have a significant and almost unpredictable impact on the material characteristics of the final product. For these further reasons, applicant respectfully submits that Santana fails to disclose at least one step of Claim 10. Reconsideration and removal of this 35 U.S.C. § 102(b) is respectfully requested.

Dependent Claims 11 – 17 are likewise patentable, at least by virtue of their dependency from patentably distinct base Claim 10. Reconsideration and removal of this 35 U.S.C. § 102(b) rejection of Claims 11 – 17 is respectfully requested.

Additionally, Santana discloses that silicon powder be pressed at a pressure in the range of 13.18 Pa to 20.67 Pa. Whereas, Claim 14, for example, recites that the pressure in compacting step ranges between 10 MPa and 1 GPa. Santana, thus fails to teach or disclose at least one step of Claim 14. Reconsideration and removal of this 35 U.S.C. § 102(b) rejection of Claim 14 is respectfully requested.

#### 35 U.S.C. § 103 Claim Rejections

Claims 18 and 19 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Santana in view of Vander Sande (U.S. Patent No. 4,849,033).

Dependent Claims 18 and 19 depend ultimately from patentably distinct base Claim 10. As set forth above, Santana fails to disclose all the steps of Claim 10. Vander Sande fails to cure these deficiencies of Santana. Vander Sande discloses merely the

step of annealing a GaP doped SiGe alloy at a temperature above the melting point of the alloy to improve the thermoelectric conversion efficiency. See Abstract. Vander Sande fails to teach or suggest the step of sintering a powder for forming semiconductor granules as recited in Claim 10. Accordingly, reconsideration and removal of this 35 U.S.C. § 103(a) rejection of Claims 18 and 19 is respectfully requested.

New Claims 20 – 33

Newly added dependent Claims 20 – 30 further define the characteristics of the granules formed by the method of Claim 10 and are supported by the specification. No new matter has been added.

Particularly, new claim 20 recites that the “granules have a diameter/thickness ratio in the range of about 1 to 1.66.” Support is found in the specification. See, for example, Page 5, lines 28 – 33 (“To give an idea, thickness  $e$  is from 1 to 3 millimeters and diameter  $\Phi$  is on the order of from 1 to 5 mm.”). No new matter has been added. Santana fails to even hint at such formation.

New claim 21 recites that “said granules have a porosity generally ranging between 20 % and 40 %.” Support is found in the specification. See, for example, Page 4, line 34 to Page 5, line 6 (“If they have not have been annealed up to the melting point, the granules obtained by the method of Fig. 2 exhibit a relatively high porosity, generally ranging between 20 and 40%.”). No new matter has been added. The wafer disclosed by Santana has a density which is greater than 92 % of the theoretical density

of silicon. See Abstract. In contrast, the granule of method 21 has a porosity ranging from about 20 % to 40 %.

New claim 22 recites that the “granules are cylindrical in shape,” and claim 23 recites that the “granules have a shape selected from the group consisting of cubes, rectangle parallelepipeds and elongated.” Support is found in the specification. See, for example, Fig. 3; see also Page 7, lines 22 – 26. (“Although cylindrical granules have been shown, the granules may be in the shape of cubes, of rectangular parallelepipeds, or other, according to the shape of openings 5 of mould 3.”). No new matter has been added.

New claim 24 recites that the “mold comprises a plate having a plurality of openings,” while claim 25 recites that “openings have a diameter in the range of about 1 to 5 millimeters.” Claim 26 recites that the plate has a thickness in the range of 1 mm to about 3 mm. Support is found in the specification. See, for example, Fig. 1B, see also Page 3, line 31 to Page 4, line 2 (“Mould 3 is a plate pierced with openings 5.”). No new matter has been added.

New claim 27 recites that the “granules have a diameter in the range of about 1 mm to 5 mm”, while claim 28 recites that the “granules have a thickness in the range of about 1 mm to 3 mm.” Support is found in the specification. See, for example, Page 5, lines 28 – 33 (“To give an idea, thickness  $e$  is from 1 to 3 millimeters and diameter  $\Phi$  is on the order of from 1 to 5 mm.”). No new matter has been added.

New claim 29 recites that “powders are sized in the range of about 10 nm to 500 nm,” while claim 30 recites that “powders are sized in the range of about 10  $\mu\text{m}$  to 500  $\mu\text{m}$ .” Support is found in the specification. See, for example, Page 3, lines 18 – 20

("The used powders for example are powders of nanometric sizes (from 10 to 500 nm) or micrometric size (from 10 to 500  $\mu\text{m}$ ) coming from the CVD reactors."). No new matter has been added. This contrasts with the powder size disclosed in Santana, which is in the range 0.05 – 3  $\mu\text{m}$ , also containing "a small amount of polycrystalline silicon pellets ( $\approx 10$  vol %) intermixed in the powder." See, Section titled "Experimental procedure." Claims 29 and 30 are therefore patentable over the cited art of record.

New claim 31 depends from claim 14 and recites the further feature that the temperature is greater than 800°C.

Newly added independent claim 32 recites a method including the steps of sintering powders of at least one of the listed materials so as to form granules and feeding granules to a semiconductor melt to form semiconductor ingots. Support is found in the specification. See, for example, Page 2, lines 6 – 9. ("An object of the present invention is to provide a method for manufacturing granules adapted to feeding a semiconductor material ingot manufacturing melt, which is fast, inexpensive and consumes little power."). Santana clearly fails to disclose or suggest such an overall method.

New claim 33 depends from claim 32 and recites that the "granules have a diameter in the range of about 1 mm to 5 mm and a thickness in the range of about 1 mm to 3 mm." Support is found in the specification. See, for example, Page 5, lines 28 – 33 ("To give an idea, thickness  $e$  is from 1 to 3 millimeters and diameter  $\Phi$  is on the order of from 1 to 5 mm."). Again, Santana does not even contemplate the overall method and clearly fails to teach or suggest the additional features of dependent claim 33.

For at least the reasons as set forth above, Santana fails to disclose at least one feature of Claim 10. Accordingly, at least by the virtue of their dependence from Claim 10, and for the further reasons set forth above, Claims 20 – 31 are likewise not anticipated by Santana nor rendered obvious by the combination of Santana with any of the references of record. Allowance of newly added dependent claims 20 – 31 is, therefore, respectfully requested. Furthermore, independent method claim 32 recites a process by which granules formed by a particular method are then fed to a melt so as to form ingots. Santana's wafer production process fails to disclose or render obvious applicants claimed method as recited in claim 32 and dependent claim 33. Allowance of newly added claims 32 – 33 is, therefore, respectfully requested.

*Double Patenting*

Claims 10 and 18 stand provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1 and 4 of copending Application No. 10/552,548. Applicant notes that the present application was filed on June 15, 2006, whereas copending Application No. 10/552,548 was filed on January 3, 2007. Attention is kindly drawn to MPEP § 804(I)(B)(1) which states that a terminal disclaimer should not be required for an earlier filed application and that such earlier filed application should be permitted to issue as a patent without terminal disclaimer. Reconsideration and removal of this nonstatutory obviousness-type double patenting rejection of Claims 10 and 18 is respectfully requested.

**CONCLUSION**

Applicant believes he has addressed all outstanding grounds raised by the Examiner and respectfully submits the present case is in condition for allowance, early notification of which is earnestly solicited.

Should there be any questions or outstanding matters, the Examiner is cordially invited and requested to contact Applicant's undersigned attorney at his number listed below.

Respectfully submitted,



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